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FORECASTS OF DEFENSE CONTRACT MANAGEMENT COMMAND UNIT COST PRODUCTS/SERVICES

August 1993

FOR

DEPARTMENT OF DEFENSE

DEFENSE LOGISTICS AGENCY

DEFENSE CONTRACT MANAGEMENT COMMAND

Cameron Station

Alexandria, VA 22304-6100

INSIGHT THROUGH ANALYSIS

DOR0   CORPORATE RESEARCH

DLA-93-P20340

FORECASTS OF DEFENSE CONTRACT MANAGEMENT COMMAND UNIT COST PRODUCTS/SERVICES

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FOREWORD

This report outlines the methodologies and fiscal year 1994
workload forecasts for the 18 Defense Contract Management Command
(DCMC) unit cost products and services. The success of this
effort was largely due to the data collection support from
numerous offices. These offices included: the Defense Logistics
Agency Performance Standards Support Office in Chicago, all of the
functional areas in Contract Management and the Policy Group in
the Procurement Business Area.

CHRISTINE L. GALLO
Executive Director
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SECTION 1
INTRODUCTION

1.1   BACKGROUND

Needing better cost visibility, the Department of Defense divided
itself into business areas, one of which is the Defense Contract
Management Command (DCMC). Products and services were identified
in each business area. DCMC chose 18 cost indicators to serve as
proxies for all DCMC products and services. The cost of each
indicator is currently being calculated. Future DCMC budgets will
be based on the projected number of work units completed for each
of the 18 indicators.

1.2   SCOPE

Each of the 18 unit cost indicators was considered independently
to determine what method could be used to develop a workload
forecast. We worked with the indicators at the DCMC level.
Results of the DCMC level explorations demonstrated that examining
data at a lower organizational level would not have been
productive.

1.3   OBJECTIVE

The primary objective was to develop a workload forecasting
methodology for each of the 18 DCMC unit cost indicators. Drivers
of individual cost indicators were desired that are global,
external to Defense Logistics Agency (DLA) and non-tamperable.
Finally, a forecast for each of the 18 indicators was requested
for fiscal year 1994.

SECTION 2
METHODOLOGY

Regression, time series analysis and ratio analysis were the forecasting techniques we considered. Time series techniques forecast next year from the trends of preceding years. The Department of Defense's (DoD) sharply declining budgets and DCMC's declining workload rendered this approach impractical. Regression involves tying a forecast statistically to another variable. For example, the cost of building a home may be forecast from a formula based on the size of the home in square feet. Size is the independent variable and the item to be forecast, in this case the cost, is the dependent variable. The forecasting formula is produced by using regression analysis on historical data for both variables. Independent variables may be chosen to satisfy the external, non-tamperable and global objectives for our unit cost drivers. Ratio analysis equates the rate of change in a driver with the rate of change in the variable to be forecast. Regression and ratio analysis were used to develop the workload forcasts.

Using regression presented several challenges: identifying possible independent variables that are drivers of our unit cost counts, determining the availability of historical data for both drivers and unit cost indicators, and collecting and analyzing the data. Collecting and analyzing the data consumed the most time.

Personnel from the office of the Executive Director (Contract Management), DLA Performance Standards Support Office (DPSSO), field functional elements and the DLA Operations Research Office (DORO) suggested many possible unit cost workcount drivers. Each suggestion was examined, but most proved impractical due to a lack of historical data. Seven unit cost products/services had no history available. Three other indicators had only two years of history. We explored these indicators using monthly data but did not discover any usable relationships. The swings in monthly data proved random and volatile. Forecasts of indicators with insufficient history were tied to the change in the total of DoD Procurement outlays and Research, Development, Test & Evaluation (RDT&E) outlays from FY 93 to FY 94.

With one exception, the most productive regression analyses used DoD Procurement outlays and RDT&E outlays as independent variables. This data covered the FY 85-92 time period and was expressed in constant FY 93 dollars. DoD published these figures in the document *NATIONAL DEFENSE BUDGET ESTIMATES FOR FY 1994.*

Termination for Convenience was the one unit cost service for which we used a different independent variable. We found the number of terminations dockets (or cases) opened the previous year an excellent driver for the number of dockets closed.

SECTION 3
RESULTS

3.1   FORECASTING METHODOLOGIES

We forecast the unit cost products/services using regression
and ratio analysis.

We regressed the unit cost work counts against DoD outlays for
Procurement, RDT&E and the sum of both. These outlays, expressed
in constant FY 93 dollars, logically effect DCMC workload. We
used the outlays from the previous year, where possible, to
reflect the budget to workload lag. In the case of terminations,
cases opened the previous year proved a more satisfactory driver.
Regression analysis produced forecasts for the following:

PRODUCT/SERVICE   TITLE
NUMBER (PSN)

6100   Quality Assurance
6170   Transportation
6180   Termination for Convenience

For five other unit cost indicators, we chose data elements from
the RCS 448 report to serve as proxies for a unit cost count. We
then regressed the proxy against the aforementioned DoD budget
data to derive a forecasting formula for the proxy. We computed
the unit cost forecast by multiplying the proxy forecast by an
adjustment factor. The adjustment factor was derived from the
ratio of the unit cost product/service to the proxy count. This
approach worked for the following indicators:

PRODUCT/SERVICE   TITLE
NUMBER (PSN)

6010   Core Contract Administration
6030   Pricing/Negotiations
6070   Progress Payments

The six unit cost indicators listed above comprise over 65% of the
total costs captured by the unit cost system. The remaining unit
cost work counts were forcasted by multiplying the annualized
workcounts for FY 93 (derived from April data) times the ratio of
the FY 94 sum of DoD Procurement and RDT&E outlays to the FY 93
sum of Procurement and RDT&E outlays. DoD budget data was
expressed in constant FY 94 dollars. This ratio couples the
concept of a global, external to DLA variable with the fact of a
sharply declining DoD budget.

3.2   UNIT COST FORECASTING RESULTS

The FY 94 unit cost forecasts follow. Appendix A contains the formulae and calculations for each forecast. This Appendix also includes regression statistics and a list of proxy variables.

PSN	TITLE	FY 93 (Thru May) ANNUALIZED	FY 94 FORECAST
6010	Core Contract Administration	320,783	281,096
6020	Preaward Surveys	6,222	5,765
6030	Pricing/Negotiations	14,402	12,492
6040	Over and Above Work Requests	123,269	114,208
6050	Price-Related Systems Surveillance		N/A *
6060	Large Businesses' Plans for Sub-contracting with Small Businesses and Disadvantaged Businesses	4,700	4,354
6070	Progress Payments	42,737	41,371
6080	Cost Surveillance	19,176	17,767
6090	Property Management	28,598	26,496
6100	Quality Assurance (QA)	292,565	271,953
6110	Mandatory QA Inspection Requirements	10,788	9,995
6120	Program Integration	12,374	11,464
6130	Engineering Surveillance	21,924	20,313
6140	Manufacturing Systems Evaluation	5,784	5,359
6150	Production Surveillance	304,614	282,225
6160	Flight Operations	1,382	1,280
6170	Transportation	111,254	103,202
6180	Termination for Convenience	5,136	5,908

* No work unit to count has yet been defined for this PSN; therefore no forecast was produced.

SECTION 4
CONCLUSIONS

The forecasts generated in this report fulfill the objective of using unit cost drivers that are global, external to DLA and non-tamperable.

Most forecasting techniques rely heavily on historical data. Unfortunately, sufficient historical data is not available for many of the unit cost indicators.

Yearly data yields the most promising statistical relationships. Monthly data is prone to volatile, seemingly random swings.

Useful forecasts, tied to global DoD budget items, can be produced to assist DCMC management in predicting DCMC budgets. When changes occur in the DoD budget, new unit cost estimates can easily be generated using these forecasting methods.

SECTION 5
RECOMMENDATIONS

The forecasts produced in this report should be used by DCMC management as an input in estimating future DCMC budgets.

As more unit cost history becomes available, these forecasts should be reevaluated and revised.

At the end of FY 94, the models should be evaluated to see if they are accurate predictors. If modifications are needed to improve the models, they should be made at that time.

The forecasting models should be run each May so that results can be used in the budget formulation process.

APPENDIX A
FORECASTING FORMULAE

APPENDIX A
FORECASTING FORMULAE

REGRESSION FORECASTS

Regressions were run on the following yearly DoD budget data
expressed as constant FY 93 $ in millions:
- Procurement Outlays   (Shown as PROC)
- RDT&E Outlays   (Shown as RDT&E)
- Total Procurement and RDT&E Outlays   (Shown as TOTAL)

Since DCMC work lags behind the actual budget outlays, we
used the outlays from the previous year as the drivers, where
possible.

The Coefficient of Determination or R^2 is that portion of the
total variation in the dependent variable (unit cost work count)
that is explained by the regression equation. For example, the
R^2 in PSN 6010 shows that the regression equation explains 84.9
percent of the variation in the number of contracts closed.

Outliers are those fiscal years that have been excluded from the
analysis due to their extreme values. Outliers cloud underlying
statistical relationships.

FY94 FORECAST CALCULATIONS
(Budget figures in constant FY 93 $ in millions)

6010 *   Core Contract Administration
 Formula: [1.307 (FY 94 TOTAL) + 177,370] x.92 = Contracts Closed
 Forecast: [1.307 (98,063) + 177,370] X .92 = 281,096
 R^2: 84.9%
 Period: FY 85 - FY 92 Outliers: FY 88 & FY 90

6030 *   Pricing
 Formula: [.26398 (FY 94 PROC) - 6,910] X 1.37 = Pricing Cases
 Forecast: [.26398 (60,719) - 6,910] X 1.37 = 12,492
 R^2: 82.4%
 Period: FY 85 - FY 92 Outliers: FY 86, FY 90 & FY 91

6070 *   Progress Payments
 Formula: [.10127 (FY93 RDT&E) + 3,115] X 6.0 = Progress Payments
 Forecast:[.10127 (37,328) + 3,115] X 6.0 = 41,371
 R^2: 95.8%
 Period: FY 85 - FY 92 Outliers: FY 87, FY 88 & FY 92

6100   Quality Assurance (QA)
 Formula: 3.46889 (FY 94 TOTAL) - 68,217 = QA Contracts Closed
 Forecast: 3.46889 (98,063) - 68,217 = 271,953
 R^2: 80.9%
 Period: FY 86 - FY 92   Outliers: FY 88 & FY 91

6170   Transportation
 Formula: 1.12923 (FY 94 PROC) + 34636 = Government Bills of
          Lading (GBLs)
 Forecast: 1.12923 (60,719) + 34,636 = 103,202
 R^2:   83.3%
 Period: FY 86 - FY 92 Outliers: FY 89 & FY 90

6180   Terminations
 Formula: 1.184 (FY 93 TERM. DOCKETS OPENED) - 322 = Terminations
 Forecast: 1.184 (5262) - 322 = 5,908
 R^2:   98.2%
  Period: FY 86 - FY 92   Outliers: None

* Regressions for these PSNs were actually run against proxy
variables from the RCS 448 report as listed below. A ratio of the
annualized unit cost workcount (through May) to an annual proxy
count was calculated. We multiplied the regression formula
results by these ratios to produce the unit cost forecasts.

PSN RCS 448 Proxy Data Elements
 6010 - 030A038 (Prime Contracts Closed, ACO Assigned - Total) +
        040B008 (Prime Contracts for Support Administration   +
                 Closed, ACO Assigned)
        050B008 (Subcontracts for Support Administration Closed,
                 ACO Assigned)
 6030 - 140A007 (Pricing Cases Completed)
 6070 - 622B158 (Physical Progress Reviews Completed)

RATIO FORECASTS

The following forecasts were produced by:

1. Annualizing the FYTD unit cost workcount from unit cost reports through May. For PSN 6040 the May FYTD count was 82,179. The unit cost number was annualized as follows:
$$(82,179/8) \times 12 = 123,269.$$

2. The change in the DoD budget for Procurement and RDT&E outlays was as follows (expressed in constant FY 94 $ in millions):

	FY 93	FY 94
PROCUREMENT OUTLAYS	70,157	62,174
RDT&E OUTLAYS	38,199	38,215
TOTAL	108,356	100,389

$$\frac{100,389}{108,356} = 92.65\%$$

3. We multiplied the annualized figure of 130,941 by .9265 to account for the reduced DoD budget and produce the FY 94 forecast.
$$123,269 \times .9265 = 114,208$$

PSN	TITLE	ANNUALIZING FYTD 93 COUNTS (THRU APRIL)	FORECASTING FORMULA	
6020	Preaward Surv.	4,148 x (12/8) =	6,222 x .9265 =	5,765
6040	Over & Above	82,179 x (12/8) =	123,269 x .9265 =	114,208
6060	Lge Busi. Subs	3,133 x (12/8) =	4,700 x .9265 =	4,354
6080	Cost Surveil.	12,784 x (12/8) =	19,176 x .9265 =	17,767
6090	Prop. Manag.	19,065 x (12/8) =	28,598 x .9265 =	26,496
6110	Mand. QA Req.	7,192 x (12/8) =	10,788 x .9265 =	9,995
6120	Prog. Integ.	8,249 x (12/8) =	12,374 x .9265 =	11,464
6130	Eng. Surveil.	14,616 x (12/8) =	21,924 x .9265 =	20,313
6140	Man. Sys. Eval.	3,856 x (12/8) =	5,784 x .9265 =	5,359
6150	Prod.Surveil.	203,076 x (12/8) =	304,614 x .9265 =	282,225
6160	Flight Ops	921 x (12/8) =	1,382 x .9265 =	1,280

APPENDIX B
FYTD UNIT COST STATISTICS

APPENDIX B
FYTD UNIT COST STATISTICS
(MAY 1993)

RANKED IN ORDER OF PERCENT OF TOTAL COSTS

PSN	TITLE	COSTS	PERCENT		UNITS
6100	QUALITY ASSURANCE	275,976,220	40.7%	*	195,043
6010	CORE CONTRACT ADMIN.	106,516,027	15.7%	*	213,855
6130	ENGINEERING SURVEILLANCE	49,593,814	7.3%		14,616
6150	PRODUCTION SURVEILLANCE	45,263,935	6.7%		203,076
6030	PRICING/NEGOTIATION	45,157,822	6.7%	*	9,601
6120	PROGRAM INTEGRATION	27,843,469	4.1%		8,249
6090	PROPERTY MANAGEMENT	27,711,045	4.1%		19,065
6050	PRICE-RELATED SYS. SURV.	22,609,754	3.3%		0
6110	MANDATORY QA INSP.	21,671,416	3.2%		7,192
6140	MANUFACTURING SYS. SURV.	12,002,097	1.8%		3,856
6180	TERMINATION / CONVENIENCE	9,727,450	1.4%	*	3,424
6170	TRANSPORTATION	8,907,314	1.3%	*	74,169
6160	FLIGHT OPERATIONS	6,590,337	1.0%		921
6020	PREAWARD SURVEYS	6,553,564	1.0%		4,148
6040	OVER & ABOVE WORK REQ.	3,769,058	0.6%		82,179
6070	PROGRESS PAYMENTS	3,659,010	0.5%	*	28,491
6080	COST SURVEILLANCE	2,846,042	0.4%		12,784
6060	LRG BUSINESS' SUBCONT.	1,683,292	0.2%		3,133

* Forecasts based on regression formulae

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13. ABSTRACT (Maximum 200 words)

This report presents forecasting methodologies for each of the 18 unit cost products/services currently used by DCMC. All of the forecasts save one are based on the following: DoD Procurement outlays, DoD Research, Development, Test & Evaluation (RDT&E) outlays, or the sum of both. The forecast for the terminations unit cost count was based on dockets opened the previous year. Where possible, the outlays from the previous year were used to recognize the lag between the budget and DCMC workload. Forecasts were prepared for Fiscal Year 1994 for each of the unit cost indicators.

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